Contact: Lynnea Bylund
PHONE: 888 625 3995
FAX: 954 337 2662
EMAIL: lynnea@catalysthouse.com
URL: www.catalysthouse.com

The Solar Solution

Renewable energy is starting to capture corporate America's attention. With the power crisis worsening, solar is taking its place in the sun.

BY SCOTT HARRIS HUNTINGTON BEACH, CALIF.

THE INDUSTRY STANDARD April 2, 2001

LIKE GIANT ROBOTIC SUNFLOWERS, THE machines that Boeing engineer Kenneth Stone has tended for nearly 20 years awaken with the dawn. Planted in a sunny spot between a hangar and an office trailer on a Boeing compound in this Southern California beach town, these shimmering 50-foot-tall solar dishes tilt their mirrored petals to the morning glow. Through the day, they slowly pivot, tracking the sun's arc across the sky, capturing, reflecting and focusing its rays to power an attached engine that generates electricity. In his mind's eye Stone sees vast, beautiful fields of solar dishes sprouting in the deserts of the Southwest, converting sunlight into electricity to power Cities --without producing pollution, without accelerating global warming.

Has Stone been out in the sun too long? Not according to energy experts. "This isn't some mad scientist's mad dream. This is real," says Terry Peterson, a solar market specialist with the Electric Power Research Institute, a non-profit research institute funded by the power industry.

Solar is on the brink of a break-through, its prospects brightening as the: nation's power crisis -- the blackouts that darkened California last week were just the latest manifestation -- spurs investment in alternative energy by municipalities, businesses and home owners. The mayor of sunny San Diego, hit hard by soaring electricity prices last summer, envisions the city's landfills covered with "solar farms" that both harness the suns rays and burn landfill gasses. Up the coast, San Francisco's supervisors are proposing a $100 million solar bond to install photovoltaic panels on municipal properties. Meanwhile, Fortune 500 powerhouses such as Bechtel, Boeing and Scientific Applications International Corp. are pursuing a more ambitious dream: bringing to market large-scale, centralized solar power. Demonstration projects are already running or being developed in Arizona, Nevada and Spain. Stirling Energy Systems, a company that owns the dish technology that Boeing is helping to develop through a U.S. Department of Energy contract, has struck, deals with utilities in South Africa and Spain for test projects. "We're optimistic," Boeing project manager Mike McDowell says of the technology that Stone has nurtured. We're trying to create a market."

Stone's specialty is Stirling dish technology, one promising branch of the family of

renewable “solar thermal” energy sources. Although most people equate solar energy with rooftop panels that produce modest levels of wattage help heat homes and run appliances, solar thermal technologies are designed to provide power on an industrial scale. An early generation “solar trough” thermal plant built in the 1980s in the desert near Barstow, Calif., generates five, times the wattage produced by all the solar panels in the United States. The system, which generates 354 megawatts -- enough to power about 350,000 homes -- focuses the sun’s rays to heat tubes filled with a synthetic oil; the heated oil runs steam turbines to produce electricity. Stirling dish technology is even more efficient at converting the sun’s energy into electricity, according to a Department of Energy study.

Another solar thermal technology, known as “power tower”, is superior to the trough as well. While less efficient than Stirling dish in converting the sun’s energy to electricity, it possesses a storage system that stretches power production beyond sunset. Bechtel subsidiary Nexant is developing a massive power tower project in the Spanish region of Andalucia. More than 1 square kilometer of mirrors will focus the sun’s rays to heat a tower filled with, tubes of molten salt. The heated salt stores energy that powers electricity-producing generators.

So why has the U.S. let these promising solar technologies languish for two decades? The question is even more urgent considering, the international campaign to curb global warming caused by the burning of fossil fuels. The answer lies in the geopolitics of energy, the inconsistency of domestic power policies and the economics of a volatile marketplace in the throes of deregulation. Shifts in all these areas will determine the fate of solar development.

Stone, the Boeing engineer, has a personal slant on the history. Now white-haired at 68, Stone was in his early 40s and working on ballistic missile systems for McDonnell Douglas, when he first set out to harness the sun’s power. He did it in his free time, as a volunteer for the Los Angeles Foundation for the Junior Blind, creating a solar heating system for the group’s swimming pool. When McDonnell Douglas, searching for a new revenue stream, created an energy division in the early 1970s, Stone jumped at the challenge. “It was something the U.S needs, something the world needs -- a clean energy source,” he says.

McDonnell Douglas was ahead of the curve, embarking on solar research before the energy crisis of the 1970s hit. With OPEC raising oil prices past $50 a barrel and Americans lining up at gasoline pumps, the government poured support into research and development of renewable energy sources such, as solar, wind, geothermal and biomass. At one point, Stone recalls, McDonnell Douglas had about 50 engineers assigned to its energy division, Stone worked on the fledgling Solar One power tower at its test site near Barstow, which used the sun’s rays to heat water. In the early 1980s, Stone switched to the development of the Stirling dish after McDonnell Douglas entered a partnership with the Swedish firm Kockums, a manufacturer of an unusual closed-loop solar Stirling engine.

Stirling dish wasn't a new concept; scientists have recognized the potential of Stirling technology for generations. The Stirling engine is an external combustion engine, relying on heat to cause hydrogen to expand and drive the pistons. Robert Stirling, a Scottish minister, conceived of the closed-loop engine in the early 1800s as an alternative to steam engines, which had a lethal habit of blowing up. A French inventor later attached a solar collector to a Stirling engine, according to Barry Butler, a Scientific Applications International VP overseeing its energy division. Stirling engines, he says, are now used in everything from submarines to prototypes of artificial hearts, used in animals. SAIC has developed a hybrid Stirling dish that runs on sunlight during the day and burns landfill gases at night to provide power. The company is in discussions with San Diego about constructing solar power plants on its landfills.

Sun king: Stirling Energy's Slawson wants to build a solar power plant in the Nevada desert.

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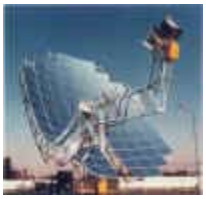
The Stirling engine remains buggy, and maintenance is a concern, experts say, but technological advances make engineers optimistic about its prospects. The Stirling engine is "about where the car engine was in the 1950s," Stone says. "From a technology standpoint, I don't see anything that would stop this. But so many political things have stopped it before."



The politics and economics begin on the world stage and trickle down to, the corporate boardroom. SAIC's Butler has worked on solar energy as long as Stone has, first at Sandia National Laboratory in New Mexico, then at the Department of Energy's National Renewable Energy Laboratory in Colorado. In 1984, with oil at $38 a barrel and prices expected to rise past $60, Butler joined SAIC with plans to make solar energy commercial. Two years later, however oil, prices plummeted to $16 - and solar research funding tumbled along with it.

With federal support drying up McDonnell Douglas management decided to pull the plug on its energy projects. It sold the Stirling dish prototypes and the technology to Southern

California Edison. Stone continued to work on the project part time, spending weekends in the desert as an independent consultant to the utility. But when state regulators, ruled that Southern California Edison couldn't pass the research and development costs to its customers, the utility abandoned the project and padlocked the site.

Today, Stone's solar sunflowers might be rusting in the California desert if not for entrepreneur David Slawson, the 52-year-old founder and CEO of Stirling Energy Systems. Hardly the J. R. Ewing stereotype of an energy executive, Slawson's roots are in holistic health; he owns a massage therapy college in Oregon. One morning, he says, he woke up in Portland, and smelled exhaust fumes coming through his bedroom window. After reading up on alternative energy, he relocated to Maui with dreams of developing hydrogen-powered cars -- a dream others still pursue. His efforts in Maui foundering, Slawson learned that the promising Stirling dish technology had been abandoned.

Sun king: Stirling Energy's Slawson wants to build a solar power plant in the Nevada desert.

Cheryl Himmelstein

Eventually rounding up 180 investors, Slawson established Stirling Energy Systems in 1996 in Phoenix, bought the rights to the technology from Southern California Edison and established partnerships with Boeing (which had since acquired McDonnell Douglas) and Kockums. The Stirling dish units that established efficiency records in Barstow were dismantled and reassembled in Huntington Beach.

Wary of offending powerful and entrenched energy interests, Slawson is careful to say that solar should be developed to augment power supplies, not replace the fossil fuel, nuclear and hydropower sources. "We need all the energy we can get," he says, adding that solar will help meet peak daytime demand. The initial capital costs are expected to be large but the fuel -sunlight -- is free, lending a dose of stability to a market subject to volatile natural gas prices.

The political outlook for solar in the United States is mixed. On the plus side, a number of states promote solar development, and President Bush's budget, includes a 15 percent tax credit for photovoltaic installations. But Bush's recent reversal of a campaign promise to regulate carbon dioxide emissions was viewed as a triumph for the coal industry and a blow to renewable energy. Nevertheless, Bush's flip-flop and the controversy over oil and gas drilling in the Alaska wilderness will focus attention on solar as a key element of the nation's energy policy.

Solar advocates say that renewable energy, which provides a pittance of the nation's power, needs federal support because private companies are focused on short-term earnings. The global population boom and accelerating industrialization, in developing countries, says SAIC's Butler, is on a collision course with the diminishing supply of fossil fuels. "You can't just keep punching holes in the ground," he says.

Bechtel, Boeing and other corporate converts to solar energy are embracing the idea that green is good.

The great advantage of fossil fuels is that they currently are far cheaper than solar-generated electricity. Slawson's prototype solar dishes cost $350,000 a piece. He estimates he would have to operate a 12,000 dish solar farm to be competitive with current electricity rates in California. Then again, renewable energy advocates argue that true energy costs are hidden in everything from the defense budget (think the Persian Gulf War)

to federally sponsored research. A study by the Renewable. Energy Policy Project published in July found that nuclear energy received $145 billion in direct and indirect federal subsidies over the past 50 years, compared to $4.4 billion for solar technologies. The study also illustrated how billions of federal dollars that went to jet engine research led to turbine advances that have benefited private power companies in the increasingly deregulated energy markets. The underlying point: The advantageous pricing came after massive support from taxpayers.

Meanwhile, the external costs of burning fossil fuel mount. Federal and state policies have recognized the damage done by nitrous oxide and sulfuric oxide emissions by, creating a marketplace in which these so-called NOX and SOX credits are traded as a means of encouraging cleaner energy production. That trend could be a boon for solar energy as companies seek to cut pollution and accumulate clean energy credits.

Renewable energy advocates hope to persuade California to extend to solar thermal technologies the subsidy it now provides the photovoltaic industry. Another objective is to pursue long-term electricity contracts with California. This month Slawson hopes to begin discussions with Silicon Valley firms about investing in solar dish technology in exchange for long-term electricity contracts. Together, the various solar thermal interests hope to build a 100 megawatt system in Nevada. If such a system were built, company executives say they could start to compete for the long-term contracts California officials are negotiating to cushion the power crisis. The Nevada project, Slawson and Butler say, will prove that their technologies are competitive in the electricity market, particularly during the high-priced daylight hours when demand peaks.

That’s the catch-22 the technology faces. To demonstrate solar’s value, proponents need to build a large project to achieve economies of scale. But to finance such a project, they need to demonstrate its efficiency.

Now may be solar’s moment in the sun. Peterson of the Electric Power Research Institute says that when electricity prices are high, it’s an ideal time to sell green power. Consumers are willing to continue paying a premium, he says, if they think it’s clean. For instance, photovoltaic panels have been flying off the shelves in California as consumers facing sky-high electricity bills take advantage of a state rebate for the purchase of such equipment. But when energy is cheap, says Peterson, it’s hard to convince society that it should pay more -- “that it would be good for your grandchildren.”

Stone says making the world better for everybody’s grandchildren has kept him going. He’s retiring from Boeing soon but is expected to take a job with Stirling Energy Systems, to keep tending to his solar sunflowers.